

REMARKS

In view of the above amendments and following remarks, reconsideration of the rejections contained in the Office Action of December 12, 2003 is respectfully requested.

By the above amendments, claims 1 and 2 and 82 and 83 are the only claims remaining in the application. Claims 1 and 82 are independent claims. Both of these claims have been proposed to be amended to include a recitation of the deaerating unit comprising:

a deaerating membrane which allows only gases to pass therethrough, a vacuum pump for removing dissolved gases from the plating liquid by drawing the gases through said deaerating membrane, and a control unit operatable to control a rotational speed of said vacuum pump to regulate the pressure on a decompressed side of said deaerating unit so as to maintain a concentration of dissolved oxygen in the plating liquid between 1 $\mu\text{g/l}$ (1 ppb) and 4 mg/l (4 ppm).

As discussed in the last response, the present invention includes a first plating liquid circulation system C_1 and a second plating liquid circulation system C_2 , for example. At least one of these systems includes a deaerator 328 for removing dissolved gases from the plating liquid. As discussed beginning on page 17 of the specification, the deaerator 328 removes dissolved gases from the plating liquid flowing through the plating liquid circulation system. The deaerator 328 is provided with a vacuum pump 329 for removing various dissolved gases, including oxygen, air, carbon dioxide and the like. The deaerator 328, as further discussed on page 17, uses a membrane which allows only gases to pass therethrough, while preventing the passage of liquid. The vacuum pump 329 removes dissolved gases from the plating liquid by drawing the gases through the membrane in the deaerator 328. As noted beginning at the top of page 18, it is possible to regulate the pressure on the decomposed side of the deaerator 328 using a control unit for controlling the rotational speed of the vacuum pump 329. With this method, it is possible to regulate the dissolved gases in the plating liquid at a desired concentration. It is further noted on page 18 that it is desirable to maintain the concentration of dissolved oxygen between approximately 1 $\mu\text{g/l}$ and 4 mg/l. With this concentration, it is possible to eliminate bubbles dissolved in the plating liquid nearly to zero, so as to result in a satisfactory plated film.

Accordingly, claims 1 and 82 have now been amended to recite that the deaerating unit includes a deaerating membrane which allows only gases to pass therethrough, a vacuum pump for removing dissolved gases from the plating liquid by drawing the gases through the deaerating membrane, and a control unit operable to control a rotational speed of a vacuum pump to regulate the pressure on a decompressed side of the deaerating unit so as to maintain a concentration of dissolved oxygen in the plating liquid between 1 $\mu\text{g/l}$ and 4 mg/l .

The Examiner again rejected the claims based upon the combination of Sakaki, U.S. 6,454,918 (Sakaki), Woodruff et al., U.S. 6,309,524 (Woodruff) and Belongia et al., U.S. 6,391,209 (Belongia). The Examiner acknowledged on page 4 of the Office Action that Sakaki fails to disclose a deaerating unit in one of the circulating systems as well as the deaerating unit comprising a deaerating membrane and a vacuum pump as previously recited in claims 3 and 84. Accordingly, the Examiner cited Belongia.

Belongia is cited by the Examiner as treating plating liquid from plating baths to remove contaminants and to adjust the plating solution for reuse. The Examiner cites column 7, line 65, to column 8, line 10, as well as column 11, lines 16-23. The Examiner further notes that the degasser of Belongia can comprise a membrane and a vacuum on one side opposite the fluid.

However, the portion cited from line 65 of column 7 to line 10 of column 8 of Belongia simply discusses a sensor 18 used in the system of the invention of Belongia. This portion of Belongia does not discuss a deaerating unit, particularly one which comprises a deaerating membrane, a vacuum pump and a control unit operable to control a rotational speed of the vacuum pump to regulate the pressure on a decompressed side of the deaerating unit to maintain the concentration of dissolved oxygen in the plating liquid between 1 $\mu\text{g/l}$ and 4 mg/l .

The cited passage in lines 16-23 of column 11 does discuss a degasser. In this passage, it is stated that "for oxidant gases, gas removal may be in the form of a simple degasser such as a membrane device with a vacuum on the side of the membrane opposite the fluid. Gas is simply pulled through the membrane and disposed of in a proper manner." However, there is no discussion of any control unit.

Accordingly, Belongia fails to disclose or suggest a control unit operatable to control a rotational speed of a vacuum pump which is part of a deaerating unit.

Furthermore, Belongia fails to disclose or suggest a control unit which controls such vacuum pump to regulate the pressure to maintain a concentration of dissolved oxygen and the plating liquid between 1 $\mu\text{g/l}$ and 4 mg/l . There is no disclosed or suggestion of any such control unit from Belongia, in particular, there is no disclosure or suggestion of any such control unit which operates the rotational speed of the pump to maintain this amount of oxygen in the plating liquid.

The Examiner took the position that the previous language employed was "intended use" language, not further limiting the structure. It is respectfully submitted that the language of the control unit recited in each of claims 1 and 82 is structural. Thus, the claims require a control unit that is operatable to control the rotational speed of the pump to maintain the concentration of dissolved oxygen in the plating liquid between 1 $\mu\text{g/l}$ and 4 mg/l .

In view of the above distinctions between the claims and the references cited by the Examiner, it is submitted that no further discussion of the differences between the present invention and the prior art cited by the Examiner is necessary at this time. However, Applicants reserve all of their rights to traverse and argue against the above and further positions taken by the Examiner with respect to the claims, including the combinability of the cited references.

In view of the above, it is respectfully submitted that all of the claims pending in the present application are now in condition for allowance. Indication of such is respectfully requested.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicants' undersigned representative.

Respectfully submitted,

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